STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

A REPORT OF

SAN JOSE STATE COLLEGE SOUND SURVEY OF MUSIC BUILDING ADDITION ACOUSTIC PROBLEMS

February 1962

State of California
Department of Public Works
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Materials and Research Department

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Mr. Anson Boyd
State Architect
Division of Architecture
Sacramento, California

Attention: Mr. John S. Moore
Supervisor, Special Projects

Dear Sir:

Submitted in accordance with your request of October 19, 1961, is:

A REPORT OF

SAN JOSE STATE COLLEGE SOUND SURVEY

OF MUSIC BUILDING ADDITION ACOUSTIC PROBLEMS

Study made by . . . . . Structural Materials Section
Under general direction of . . . . . J. L. Beaton
Tests and report by . . . . . Louis Bourget

Very truly yours,

F. N. Hveem
Materials and Research Engineer

By John L. Beaton
J. L. Beaton
Supervising Highway Engineer

LB:mw

INTRODUCTION

As requested by Mr. John S. Moore, Supervisor of Special Projects of the Division of Architecture, by letter of October 19, 1961, a study has been made of sound transmission problems in the Music Building Addition at San Jose State College.

Mr. Moore was present during all of the tests. He asked that preliminary corrective measures be tried in a few specific rooms, and the improvement in transmission loss measured before proceeding with recommendations for the entire building. This was done, and the measurements of before and after conditions are described. The results of these preliminary corrections support the effectiveness of the palliative measures as proposed in this report.

The present standard of comparison employed by the school authorities is the old portion of the music building. If the proposed recommendations are adopted, the present sound leakage problems of the new addition should be reduced to levels which will compare favorably with (or better) the old building standard.

SPECIFIC COMPLAINTS AND CORRECTIVE MEASURES

I. Small practice rooms

A. Sound leakage through closed (single) doors to corridor.

B. Sound leakage to adjacent rooms and to rooms across the corridor.

C. Rooms too "live" or reverberant.

Measurements "before and after" preliminary corrective steps and suggestions for final treatment.

A. Sound attenuation through the closed doors to the halls was 24 db before treatment. This was due to excessive leakage under the door and improper gasketing around the door. The gasket material at top and sides was too stiff to go into compression. The doors need thresholds and softer compression gaskets all the way around. The felt drop (bottom) gaskets, originally installed, are far too porous and are also subject to sticking in a partly open position.

Several sample doorways were equipped with soft gaskets, thresholds and bottom compression gaskets. The sound attenuation improved to 31 db (7 db better than the original 24 db). However, the goal should be 40 to 45 db due to the extremely high levels developed by trumpets, trombones, and heavy piano playing. The desired 40 to 45 db sound loss can be achieved by using <u>two doors</u> and proper gaskets. This is recommended for all small practice rooms.

B. Sound attenuation between small practice rooms (either adjacent or across the hall) was about 40 db. When all hollow spaces in the walls (on all sides) are filled with vermiculite, the transmission loss improves to between 45 and 55 db depending on the room location. At present, there is common air coupling through the entire length of unobstructed corridor wall sections and severe vertical leakage into the upper common air space above the rooms. The top plates on room separators are porous and the corridor partitions are actually open so that they function as sound chimneys, as shown on your Drawing D3-A. Filling these walls in several sample areas resulted in such marked improvement that the school authorities expressed satisfaction with the results. It is recommended that the vermiculite wall fill be adopted throughout the entire area.

C. Practice rooms which are used for brass instruments, such as trumpets and trombones, can be improved by the addition of acoustical material on the walls, down to a wainscot level. Mr. Moore advises that the school authorities have modified their requests to some extent on this subject. As Mr. Moore is in constant touch with the school authorities, it is suggested that the matter be left to his latest understanding of the school requirements as explained by Dr. Schneider.

II. Large rooms: classrooms, piano studios, vocal studios, and corridors.

A. Sound leakage through doors to corridors and transmission through corridors.

B. Sound leakage to adjacent rooms or rooms across the hall.

Measurements "before and after" preliminary corrective steps and suggestions for final treatment.

A. Sound attenuation through the closed, center mating, paired doors was 23 db before treatment. After installation of softer and better fitting gaskets at top, center and doorway sides, plus the installation of a threshold and soft compression gasket at the bottom of the doors (instead of the porous drop felt arrangement), the attenuation improved to 31 or 32 db (generally an 8 to 9 decibel improvement). It is recommended that this practice be followed throughout the building.

Unfortunately, fire laws prevent the use of double doors on classrooms which could effect a 40 db attenuation. Therefore, it is recommended that the side walls of the corridors be lined from the ceiling down to a wainscot level with absorptive material.

Suitable materials are available in the form of large aluminum perforated panels with pyramidal surface. These panels are placed over glass fiber blanket. The thickness of blanket controls the amount of sound absorption. It is suggested that at least a one inch fiber glass blanket be installed. (Technical information is available through Fibreglas Engineering and Supply Division, Owens-Corning Fibreglas Corporation, 1041 Fee Drive, North Sacramento 15, California.)

B. Sound attenuation between theory classrooms 210 and 213 was 39 db, even though they were across the corridor from each other. Investigation showed that the outer panels of the hollow walls along the corridor had not been completed to adequate height and sealed.

They are open at the top. This permits the hollow walls to function as sound chimneys, thereby coupling across the space above the corridor ceiling, as shown on your Drawing D3-A. The hollow walls also conduct horizontally permitting leakage to adjacent rooms.

In selected test areas, the outer corridor panels on these rooms were built up to about the same height as the inner panels and then the hollow spaces filled with vermiculite. In the case of rooms 210 and 213, this treatment improved the attenuation from 39 db to 53 db, or 14 db. The marked improvement has been acknowledged by the school staff. It is recommended that this practice be followed to completion on all classrooms throughout the building (as already advised in the area of small practice rooms) including the partition walls.

NOTE: In some walls a 1/2 inch fiber board exists in the center. Best results will be obtained if the fill is completed on both sides of the fiber board. Please refer to your Drawing D-3.

III. Band practice room 150.

Excessive ventilation system noise interferes with the musical performers and the conductor. This noise also prohibits the making of clear tape recordings that are so valuable for instructional purposes that they have become standard practice in musical education (to permit the students to hear their performance).

The environmental noise was measured at three floor positions facing the performers' locations (room vacant). These are designated as left, center, and right. All measurements are in decibels with "A weighting network" or dba.

Condition	Left	Center	Right	Change
All fans off	37-39	36-37	37-39	Reference Ø
Supply fan on	41-43	37-39	41-43	+2 to +4 db
Return air fan only	46-48	44-45	44-46	+7 to +9 db
Both fans	50-52	47-49	48-50	+11 to +13 db

As shown, the ventilation system adds about 12 db to the environmental minimum noise reference level. The return air system measures and sounds the more offensive, mainly because the measurements were made nearer to the return air apertures which are proximal to the podium as shown on your Drawing H-1.

It is important to note that if recording microphones are suspended above the musicians on long (catenary) cords or wires (a frequently preferred arrangement) the supply fan noise will nearly equal the return fan noise. Therefore, each system should be quietened by means of duct silencers of adequate size and rating to accomplish 12 db or more of reduction at the 75 cps to 150 cps end of the spectrum. The use of commercial silencers is indicated in preference to the installation of duct lining because of the greater efficiency per unit length and the ease with which they may be installed in an existing system.

Mr. Vern Thornburg, of the Division of Architecture, has catalogs and technical specifications for these devices.

Some firms that make duct silencers are:

Industrial Acoustics Co., Inc.
341 Jackson Avenue
New York 54, New York
Local representative: Norman Wright & Co.
724 24th Street
Sacramento, California

Insul-Coustic Corp.
42-43 54th Road
Maspeth 78, New York

Eloff Hansson, Inc.
Acoustical Division
711 3rd Street
New York 17, New York

The Eckel Corporation
155 Fawcett Street
Cambridge 38, Mass.

Silence Inc.
P. O. Box 21
Farmingdale, New York

Koppers Co., Inc.
Industrial Sound Control Dept.
P. O. Box 298
Baltimore 3, Maryland

In addition to the noise silencers, consideration should be given to the installation of remote control operation of both inlet and outlet fans by relay controlled switches. This could be installed so that either the muscial director or the recording machine operator, as preferred, could turn off the fans during the time a recording is being made. This final suggestion is made because the sound levels, as measured with all fans turned off, come nearer to the desired levels for obtaining good recordings.

This concludes the recommendations and report.